years, it seems as if the birds were finding out that the chimneys were no longer suitable places for rearing their young.—J. H. Sears, *Beverly, Mass.*

GEOLOGY.

The Fossils of Colorado.—The explorations this year have been more than usually productive of interesting results. The "bad lands" of Colorado have been discovered to be a graveyard of a long past period, distinct from that of Wyoming, and to contain the osseous remains of a great population of beasts, of totally different species and even orders from those of the latter age and region. They resemble more nearly those of the White River, of Nebraska, but many have been obtained by Prof. Cope not known there or elsewhere. So far he has proven the existence of more than one hundred species, some represented by thousands of individuals. Of these at least seventy species are new to science. They range from the size of the mole to nearly that of the elephant; sixteen species only are reptiles.

Many forms of insectivorous animals related to the mole, and of very small size, have been procured. The delicacy and minuteness of these fossils are surprising.

Gnawing animals, or rodents, left numerous remains of eighteen species, some not larger than the domestic mouse. Some were the predecessors of the rabbits, others of squirrels and others of mice.

Of cloven-footed quadrupeds a great many species have been found. Some were nearly intermediate in structure between the deer and the hog; like the latter, they had no horns; they were about as large as sheep. Others were about the size of gray squirrels, being the smallest of this class of animals ever discovered. Several species of horses were living during the same period, as is proven by the bones and teeth which have been discovered.

Their relative, the rhinoceros, abounded in Colorado, in former days, seven species having been procured by Prof. Cope. One of the specimens is a perfect skull, with teeth complete and covered with the moss-like crystallization seen in the moss agate. But the most remarkable monsters of the past, whose existence has been disclosed by the present survey, are a series of horned species related to the rhinoceros, but possessing some features in which, according to Prof. Cope, they resembled the elephant. They

stood high on the legs and had short feet, but possessed osseous horns in pairs on different parts of the head.

One of the largest species had a huge horn over each eye, while another had one on each side of the nose, and more than a foot in length, resembling those on the back part of the head of the ox, etc. A third one, of larger size than the last, had rudimental horns on the nose. Still another was about as large as the elephant. Its cheek bones were enormously expanded, and its horns were flat. A fifth species had triangular horns, turned outward. The first mentioned species has been named, by Prof. Cope, *Miobasileus ophryas* and the others have been placed in the new genus *Symborodon*. Their structure disproves entirely the statement of a recent writer that the presence of horns in pairs is an indication of relationship to the ruminating animals (oxen, etc.), for these beasts are quite near the rhinoceros.

Carnivorous species were not rare in this ancient family, and served as now to check their too rapid increase. Of the fourteen species known, there were tiger cats, dogs, hyænadons, and the new genus *Tomarctos*. It resembled a dog, and was as large as the black bear. Some of the cats had remarkably long canine or eye teeth. In a new species, the size of the panthers, these teeth greatly resembled those of a shark.

The reptiles embrace turtles, lizards and snakes, the last two orders discovered for the first time in this formation in America.

The forthcoming reports of Professor Hayden to the Secretary of the Interior will contain a full account of the discoveries in this interesting department of geological science, made during the progress of the survey from 1870 to the present time. Prof. Cope has obtained from the ancient sea and lake deposits of Kansas, Colorado, Wyoming, Idaho, etc., about 350 species of vertebrated animals, of which he has made known to science for the first time more than 200.

Paucity of Life in Oceanic Areas. — Prof. W. B. Carpenter concludes a recent article "On the Physical Conditions of Inland Seas," with the following remarks on the paucity of life in certain areas on the ocean bottom: —

"It is well known that a muddy state of the bottom water is unfavorable to the presence of animal life; and it has been particularly noted by Dana, that where such a sediment brought

down by a current is diffused over a part of a bed of living coral, it kills the animals of that part. Moreover, I learned at Malta that in the beds which yield the extremely *fine*-grained stone which is used for delicate carvings, scarcely any fossils are found save sharks' teeth; whilst in the *coarse*-grained beds of the same formation, fossils are abundant; and as the former may be regarded as the product of a slow deposit in the *deep* sea, so may the latter be considered as *shore* beds. Further, I have been informed by Professor Duncan, that in the Fleisch of the Alps, which shows in some parts a thickness of several thousand feet, and which is composed of a very fine sedimentary material, there is an almost entire absence of organic remains.

There is, however, another condition of the bottom-water of the Mediterranean, which is *not less* unfavorable than its turbidity —probably *yet more so*—to the existence of animal life in its depths; namely, the *deficiency of oxygen* produced by the slow decomposition of the organic matter brought down by its great rivers. According to the determination which I made in my second visit to the Mediterranean in 1871, the gases boiled off from water brought up from great depths contained only about 5 per cent. of oxygen and 35 per cent. of nitrogen, the remaining 60 per cent. being carbonic acid. Now in gases boiled off from the deep water of the Atlantic, the average percentage of oxygen was about 20, while that of carbonic acid was between 30 and 40; even this large proportion of carbonic acid not appearing prejudicial to the life of the marine invertebrata, so long as oxygen was present in sufficient proportion.

The *rationale* of both these conditions seems obviously the same;—namely, that in consequence of the uniformity of temperature of the whole mass of Mediterranean water below the surface stratum of 200 fathoms (which alone will be disturbed by wind, or be affected by the influx of rivers and of the Gibraltar current), there is *no thermal circulation;* the whole contents of the deeper part of this immense basin being thus in an *absolutely stagnant* condition. If the doctrine of a vertical oceanic circulation be true, every drop of ocean water is brought in its turn to the surface, where it can get rid of its carbonic acid, and take in a fresh supply of oxygen. But as the density of the surface stratum of the Mediterranean is never rendered greater by reduction of temperature, than that of the mass of water it overlies, there is no agency capable of producing any interchange; the bottom water charged with the slowly gravitating sediment is never disturbed; and the organic matter contained in that sediment consumes its oxygen so much more rapidly than it can be supplied from above by diffusion through the vast column of superincumbent water, that nearly the whole of it is converted into carbonic acid, scarcely any being left for the support of animal life.

These considerations, then, seem fully adequate to account for the paucity of life in the deeper part of the Mediterranean basin: and they will, of course, equally apply to the case of any other inland sea, so far as the same conditions apply. And it is not a little interesting to find that my old friend and fellow-student Edward Forbes was perfectly correct as to the limitation of animal life — so far as regards the Ægean Sea, in which his own researches were prosecuted — to a depth of about 300 fathoms; the error, which was rather that of others than his own, being in the supposition that this limitation applies equally to the great ocean basins, past as well as present. The researches in which it has been my privilege to bear a part have shown that *as regards the latter* there is probably no bathymetrical limit to animal life; while the results of my inquiries into the influence of the physical conditions of the Mediterranean, in limiting the bathymetrical diffusion of its fauna, will not, I venture to hope, be without their use in geological theory."

THE CONNECTICUT VALLEY IN THE HELDERBERG ERA. — Prof. Dana states in an article in the "American Journal of Science and Arts" for November, that the observations of Hitchcock and Percival, with his own, lead towards the view that in the Helderberg era the Connecticut valley, through its whole length from north to south, was a wide crinoidal and coral growing sea, separating eastern from western New England.

ANTHROPOLOGY.

INDIAN ROPE AND CLOTH. — The *Apocynum cannabinum*, Indian hemp, or silk plant, as it is sometimes called, is very extensively used by the Indians of Arizona for the manufacture of twine and cloth. The bark of the plant is tough and strong and something like flax. The Indians cut the plant when ripe and rub it so as to separate the fibres, with which they make very strong and beautiful fishing lines, and a fine thread which they use in sewing and also make into cloth. In the Department of Agriculture, there is a fine specimen of rope made of this fibre by the Ute Indians, which I obtained from them and presented to the Department. In the Smithsonian Collection there are also good specimens of strings and a fishing net made of this plant by the Indians of Arizona. Near Camp Lincoln in Arizona we obtained, from some old Aztec ruins, cloth that had been manufactured by hand from this plant.

The root gives out a very bitter milky fluid that is used as a medicine by the Indians. — DR. EDWARD PALMER.